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SEMICONDUCTOR



ESD



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PLED

Product data sheet

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GENERAL DESCRIPTION

LM321 是一款单路输出的低功耗差分式运算放大器, 可以单电源或双电源供电。具有较高的开环增益、内部补偿、高共模范围和良好的温度稳定性, 以及具有输出短路保护的特点。可应用于传感器的放大电路、直流放大模块, 音频放大电路和传统的运算放大电路中。

FEATURES

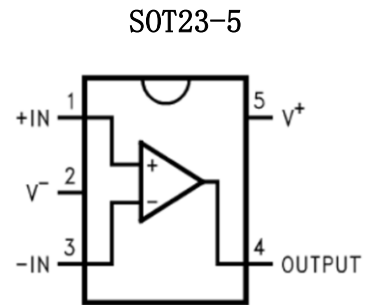
- 单电源电压范围: 3V~36V
- 双电源电压范围: $\pm 18V$
- 单位增益带宽: 可达 1.2MHz
- 输出短路保护
- 低功耗: 0.5mA @ $V+=5V$
- 封装形式: SOT23-5

APPLICATION

- 传感器信号放大器
- 直流增益
- 音频放大器
- 其它应用领域

PIN CONFIGURATION

| SOT23-5 管脚序号 | 管脚定义 | 功能说明 |
|--------------|--------|------|
| 1 | IN+ | 正相输入 |
| 2 | V- | 电源负 |
| 3 | IN- | 反相输入 |
| 4 | OUTPUT | 输出 |
| 5 | V+ | 电源正 |



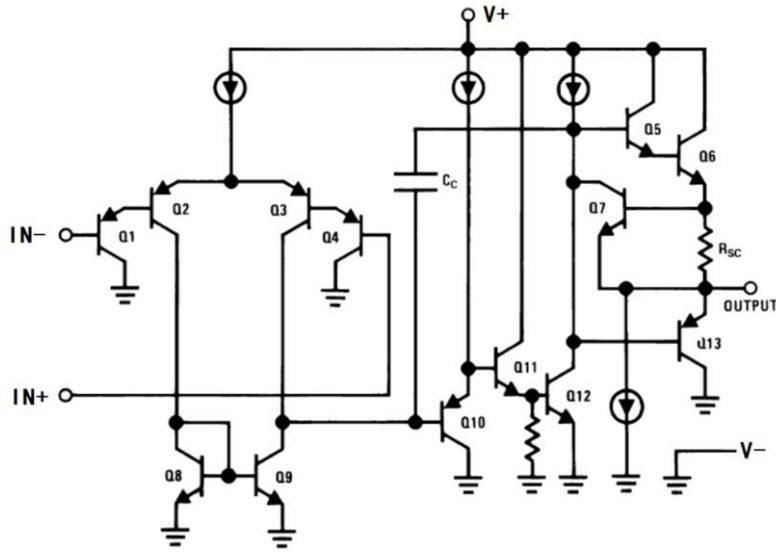
极限参数

| 项目 | 符号 | 极限值 ⁽¹⁾ | 单位 |
|-----------------------|------------------|--------------------|----|
| 单电源供电电压 | V+ | 40 | V |
| 双电源供电电压 | V _S | ± 20 | V |
| 差分输入电压 ⁽²⁾ | V _{IDR} | ± 40 | V |
| 共模输入电压 | V _{ICR} | -0.3~40V | V |
| 输出短路时间 | t _{sc} | 连续 | |
| 耗散功率 | P _D | 300 | mW |
| 工作温度 | T _A | 0~70 | °C |
| 储存温度 | T _S | -65~150 | °C |
| 焊接温度 | T _w | 260, 10s | °C |

注: (1) 极限值是指无论在任何条件下都不能超过的极限值。如果达到此极限值, 将有可能造成产品劣化等物理性损伤; 同时在接近极限参数下, 不能保证芯片可以正常工作。

(2) 输入 IN+ 与 IN- 之间的电压差。

等效原理图

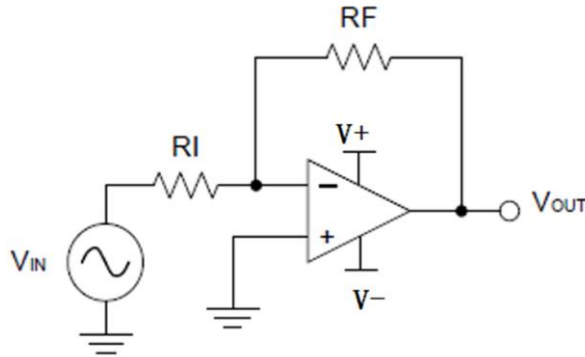


直流电学特性 (T_A=25°C, V₊ =5V, V₋ =GND 除非特别指定)

| 项目 | 符号 | 测试条件 | 最小值 | 典型值 | 最大值 | 单位 | |
|--------------------------|-------------------------------------|--|-------------------------|-----|----------------------|------|---|
| 输入失调电压 | V _{IO} | V ₊ =5V to MAX, V _{IC} =V _{ICR} (min), V _O =1.4V | - | 5 | - | mV | |
| 输入失调电流 | I _{IO} | V _O = 1.4 V | - | 10 | 50 | nA | |
| 偏置电流 | I _{BIAS} | V _O = 1.4 V | - | 50 | 250 | nA | |
| 共模输入电压 | V _{ICR} | V ₊ =5V to 36V | V ₋ | - | V ₊ -1.5V | V | |
| 开环电压增益 | A _{OL} | V ₊ =15V, V _O =1V to 11V, R _L ≥ 2k Ω | - | 100 | - | V/mV | |
| 共模抑制比 | CMRR | V ₊ =5V to MAX, V _{IC} =V _{ICR} (min) | - | 80 | - | dB | |
| 单位增益带宽 | GBWP | | - | 1.2 | - | MHZ | |
| 电源电压抑制比 P _{SSR} | ΔV _{VDD} /ΔV _{IO} | V ₊ =5V to MAX, f=20kHz | - | 90 | - | dB | |
| 输出高电平电压 | V _{OH} | V ₊ =15V, V _{ID} =1V | I _{out} =-50uA | - | 13.6 | - | V |
| | | | I _{out} =-1mA | - | 13.5 | - | V |
| | | | I _{out} =-5mA | - | 13.4 | - | V |
| | | V ₊ =28V | R _L =2k | - | 26 | - | V |
| 输出低电平电压 | V _{OL} | V ₊ =15V, V _{ID} =-1V | I _{out} =50uA | - | 0.1 | - | V |
| | | | I _{out} =1mA | - | 0.7 | - | V |
| | | | I _{out} =5mA | - | 1.0 | - | V |
| | | V ₊ =28V | R _L =2k | - | 0.85 | - | V |
| 电源工作电流 | I _{CC} | V ₊ =5V, V _O =1/2V ₊ , No load | - | 0.5 | - | mA | |
| | | V ₊ =36, V _O =1/2V ₊ , No load | - | 0.8 | - | mA | |
| 单电源工作电压 | V ₊ | V ₋ =0V (GND) | 3 | - | 36 | V | |
| 双电源工作电压 | V _S | V ₊ , V ₋ | -18 | - | +18 | V | |

典型应用

1、线路图



2、设计要求

必须选择大于输入电压范围和输出范围的电源电压。

例如，将信号源 V_{IN} 从 $\pm 0.5\text{ V}$ 放大到 $\pm 1.8\text{ V}$ 。将电源设置为 $\pm 5\text{ V}$ 足以适应此应用要求。

3、设计过程

根据公式(1)计算放大倍数(增益) A_V

$$A_V = -V_O/V_{IN} \quad \text{----- (1)}$$

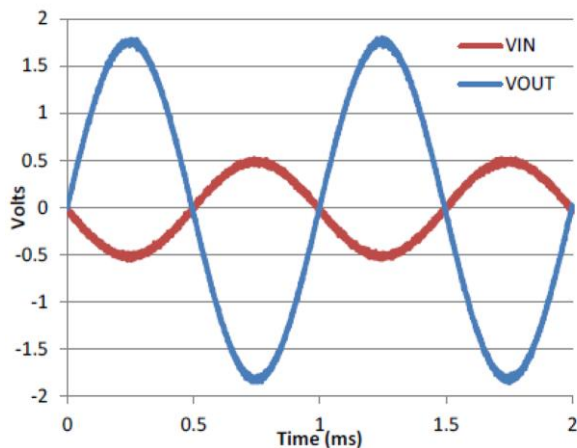
$$A_V = -V_O/V_{IN} = -1.8/0.5 = -3.6$$

一旦确定了所需的增益 A_V ，就要为 R_I 或 R_F 电阻选择一个值。根据运放的电特性及功耗的需要，可选择 $1\text{ k}\Omega$ - $100\text{ k}\Omega$ 范围内的值。本例将选择 $R_I = 10\text{ k}\Omega$ ，则 $R_F = 36\text{ k}\Omega$ 。这由方程式 2 确定。

$$A_V = -R_F/R_I \quad \text{----- (2)}$$

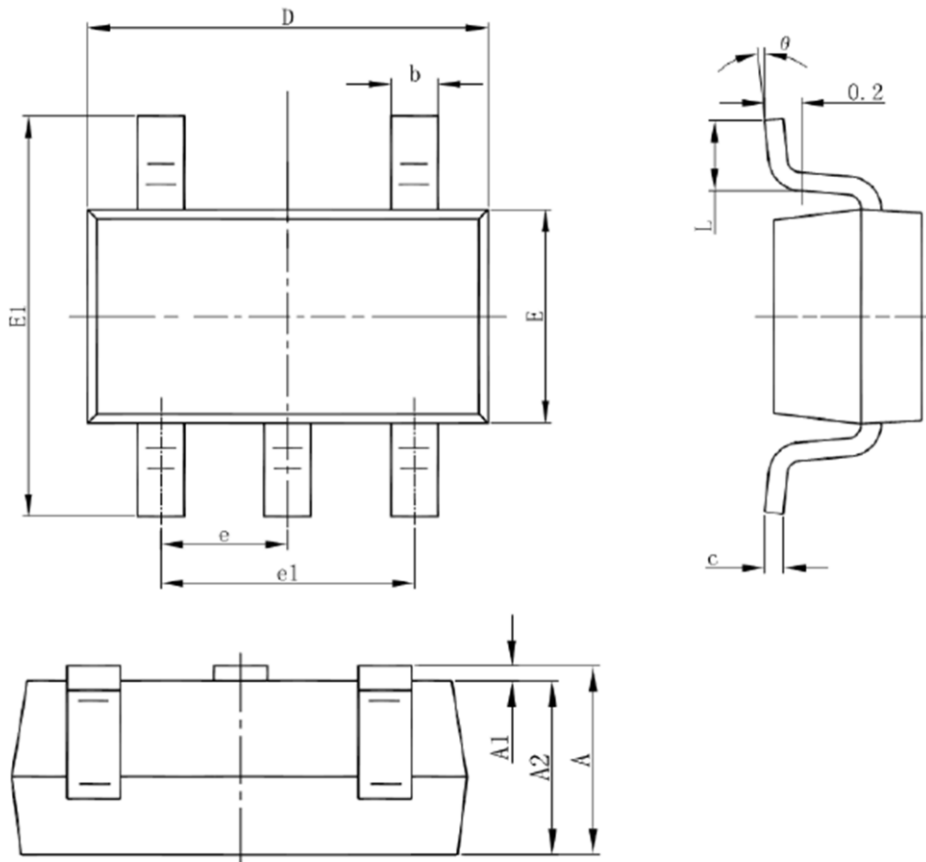
$$R_F = -A_V * R_I = 3.6 * 10 = 36\text{ k}\Omega$$

4、应用曲线图



反相放大器的输入电压 VS 输出电压

SOT23-5



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

单位：英寸/毫米

REEL SPECIFICATION

| P/N | PKG | QTY |
|-------|----------|------|
| LM321 | SOT-23-5 | 3000 |

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